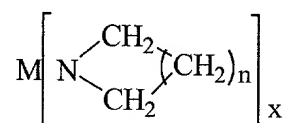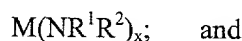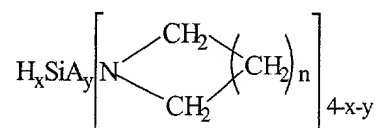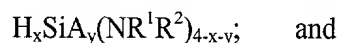# THE CLAIMS

What is claimed is:

1.   A CVD precursor composition for forming a thin film dielectric on a substrate, such precursor composition including at least one metalloamide source reagent compound selected from the group consisting of:

$$M(NR^1R^2)_x; \quad \text{and}$$

$$M\left[N\underset{CH_2}{\overset{CH_2}{<}}(CH_2)_n\right]_x$$

wherein M is selected from the group consisting of: Zr, Hf, Y, La, Lanthanide series elements, Ta, Ti, Al; N is nitrogen; each of R^1 and R^2 is same or different and is independently selected from the group consisting of H, aryl, perfluoroaryl, C_1-C_8 alkyl, C_1-C_8 perfluoroalkyl, alkylsilyl; and x is the oxidation state on metal M; and n is from 1-6.

2.   The CVD precursor according to claim 1, wherein n is 5.

3.   The CVD precursor according to claim 1, wherein n is 6.

4.   The CVD precursor according to claim 1, wherein R^1 is methyl and R^2 is ethyl.

5.   The CVD precursor composition according to claim 1, wherein the metalloamide source reagent compound is selected from the group consisting of: $Zr(NMe_2)_4$, $Zr(NMeEt)_4$, $Zr(NEt_2)_4$, $Ta(NEt_2)_5$, $Ta(NMe_2)_5$, $Ta(NMeEt)_5$, $Zr(NiPr_2)_4$, $Zr(NMe_2)_2(NPr_2)_2$, $Zr(NC_6H_{12})_4$, $Zr(NEt_2)_2(NPr_2)_2$, $Hf(NEt_2)_4$, $Hf(NMe_2)_4$, $Hf(NMeEt)_4$, $La(NMe_2)_3$, $La(NEt_2)_3$, , $La(NMeEt)_3$, $Al(NMe_2)_3$, $Al(NEt_2)_3$, $Y(NMe_2)_3$, $Y(NEt_2)_3$, $Y(NMeEt)_3$, $Ti(NMe_2)_4$, $Ti(NEt_2)_4$, $Ti(NMeEt)_4$, $Ta(NMe_2)_5$, $Ta(NEt_2)_5$.

6. The CVD precursor composition according to claim 1, wherein the metalloamide source reagent compound is selected from the group consisting of $Zr(NMe_2)_4$, $Zr(NEt_2)_4$, $Zr(NMeEt)_4$, $Hf(NMe_2)_4$, $Hf(NEt_2)_4$ and $Hf(NMeEt)_4$.

7. The CVD precursor composition according to claim 1, wherein the precursor composition further comprises a solvent medium selected from the group consisting of: ethers, glymes, tetraglymes, amines, polyamines, alcohols, glycols, aliphatic hydrocarbon solvents, aromatic hydrocarbon solvents, cyclic ethers and combinations of two or more of the foregoing.

8. The CVD precursor composition according to claim 7, wherein the precursor composition further comprises a solvent medium selected from the group consisting of: ethers, glymes, tetraglymes, amines, polyamines, alcohols, glycols, aliphatic hydrocarbon solvents, aromatic hydrocarbon solvents, cyclic ethers and combinations of two or more of the foregoing.

9. The CVD precursor composition according to claim 7, wherein the solvent is octane.

10. The CVD precursor composition according to claim 1, wherein the metalloamide source reagent compound is injected by liquid delivery into a chemical vapor deposition chamber.

11. The CVD precursor composition according to claim 1, wherein the metalloamide source reagent compounds is delivered by bubbler into a chemical vapor deposition chamber.

12. The method of claim 1 wherein the precursor composition further comprises an aminosilane source reagent compound selected from the group consisting of:

$$H_x SiA_y(NR^1R^2)_{4-x-y}; \quad \text{and}$$

$$H_x SiA_y\left[N\left\langle \begin{array}{c} CH_2 \\ CH_2 \end{array} \right\rangle (CH_2)_n \right]_{4-x-y}$$

wherein H is hydrogen; x is from 0 to 3; Si is silicon; A is a halogen; Y is from 0 to 3; N is nitrogen; each of R^1 and R^2 is same or different and is independently selected from the group consisting of H, aryl, perfluoroaryl, C_1-C_8 alkyl, and C_1-C_8 perfluoroalkyl; and n is from 1-6.

13.   The CVD precursor composition according to claim 12, wherein the aminosilane source reagent is selected from the group consisting of: $Si(NMe_2)_3Cl$, $Si(NEt_2)_2Cl_2$, $Si(NMe_2)_4$, and $Si(NEt_2)_4$.

14.   The CVD precursor composition according to claim 12, wherein the metalloamide source reagent compound and the aminosilane source reagent compound are injected by liquid delivery into a chemical vapor deposition chamber.

15.   The CVD precursor composition according to claim 12, wherein the metalloamide source reagent compound and the aminosilane source reagent compound are delivered by bubbler into a chemical vapor deposition chamber.
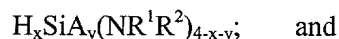
16.   The CVD precursor composition according to claim 1, wherein the precursor composition comprises multiple metalloamide source reagent compounds.
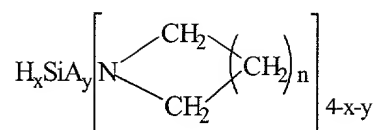
17.   The CVD precursor composition according to claim 12, wherein the precursor composition further comprises a solvent medium selected from the group consisting of: ethers, glymes, tetraglymes, amines, polyamines, alcohols, glycols, aliphatic hydrocarbon solvents, aromatic hydrocarbon solvents, cyclic ethers and combinations of two or more of the foregoing.

18.   The CVD precursor composition according to claim 12, wherein the metalloamide source reagent compounds are co-injected by liquid delivery into a chemical vapor deposition chamber.

19.   The CVD precursor composition according to claim 1, wherein the metalloamide source reagent compound is dissolved or suspended in a solvent, wherein the solvent is selected from the group consisting of: ethers, glymes, tetraglymes, amines, polyamines, alcohols, glycols, aliphatic hydrocarbon solvents, aromatic hydrocarbon solvents, cyclic ethers and combinations of two or more of the foregoing.

20.   A CVD precursor composition for forming a thin film dielectric on a substrate, such precursor composition including at least one aminosilane source reagent compound selected from the group consisting of:

$$H_xSiA_y(NR^1R^2)_{4-x-y}; \quad \text{and}$$

$$H_x SiA_y \left[N \underset{CH_2}{\overset{CH_2}{\diagdown}} \left(CH_2 \right)_n \right]_{4-x-y}$$

wherein H is hydrogen; x is from 0 to 3; Si is silicon; A is a halogen; Y is from 0 to 3; N is nitrogen; each of R^1 and R^2 is same or different and is independently selected from the group consisting of H, aryl, perfluoroaryl, C_1-C_8 alkyl, and C_1-C_8 perfluoroalkyl; and n is from 1-6.

21.   The CVD precursor according to claim 20, wherein the aminosilane source reagent is selected from the group consisting of $Si(NMe_2)_3Cl$, $Si(NEt_2)_2Cl_2$, $Si(NMe_2)_4$, and $Si(NEt_2)_4$.

22.   The CVD precursor composition according to claim 20, wherein R^1 and R^2 of the aminosilane are methyl.

23.   The CVD precursor composition according to claim 20, wherein R^1 and R^2 are ethyl.

24.   The CVD precursor composition according to claim 20, wherein R^1 is methyl and R^2 is ethyl.

25.   The CVD precursor composition according to 20, wherein the aminosilane source reagent compound is selected from the group consisting of: $Si(NEt_2)_2Cl_2$, $Si(NMe_2)_3Cl$, $Si(NMe_2)_4$, $Si(NEt_2)_4$ and $Si(NMeEt)_4$.

26.   The CVD precursor composition according to claim 20, wherein the precursor composition further comprises a solvent medium selected from the group consisting of: ethers, glymes, tetraglymes, amines, polyamines, alcohols, glycols, aliphatic hydrocarbon solvents, aromatic hydrocarbon solvents, cyclic ethers and combinations of two or more of the foregoing.

27.   The CVD precursor composition according to claim 26, wherein the solvent is octane.

28.   The CVD precursor composition according to claim 20, wherein the aminosilane source reagent compound is dissolved or suspended in a solvent, wherein the solvent is selected from the group consisting of: ethers, glymes, tetraglymes, amines, polyamines, alcohols, glycols, aliphatic

hydrocarbon solvents, aromatic hydrocarbon solvents, cyclic ethers and combinations of two or more of the foregoing.

29.   The CVD precursor composition according to claim 20, wherein the aminosilane source reagent compound is injected by liquid delivery into a chemical vapor deposition chamber.

30.   The CVD precursor composition according to claim 20, wherein the aminosilane source reagent compounds is delivered by bubbler into a chemical vapor deposition chamber.

31.   The CVD precursor of claim 20, wherein the precursor composition further comprises a metalloamide source reagent compound selected from the group consisting of::
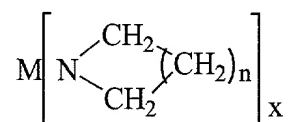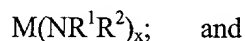
$$M(NR^1R^2)_x; \quad \text{and}$$

wherein M is selected from the group consisting of: Zr, Hf, Y, La, Lanthanide series elements, Ta, Ti, Al; N is nitrogen; each of R^1 and R^2 is same or different and is independently selected from the group consisting of H, aryl, perfluoroaryl, C_1-C_8 alkyl, C_1-C_8 perfluoroalkyl, alkylsilyl; and x is the oxidation state on metal M; and n is from 1-6; and

32.   The CVD precursor composition according to claim 31, wherein R^1 and R^2 of the metalloamide source reagent are methyl.

33.   The CVD precursor composition according to claim 31, wherein R^1 and R^2 of the metalloamide source reagent compound are ethyl.

34.   The CVD precursor composition according to claim 31, wherein R^1 of the metalloamide source reagent compound is methyl and R^2 of the metalloamide source reagent compound is ethyl.
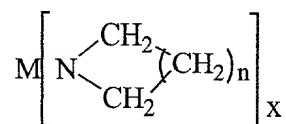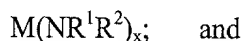
35.   The CVD precursor composition according to claim 31, wherein M is Zr.

36.   The CVD precursor composition according to claim 31, wherein M is Hf.

37.   The CVD precursor composition according to claim 31, wherein the metalloamide source reagent compound is selected from the group consisting of: $Zr(NMe_2)_4$, $Zr(NMeEt)_4$, $Zr(NEt_2)_4$, $Ta(NEt_2)_5$, $Ta(NMe_2)_5$, $Ta(NMeEt)_5$, $Zr(NiPr_2)_4$, $Zr(NMe_2)_2(NPr_2)_2$, $Zr(NC_6H_{12})_4$, $Zr(NEt_2)_2(NPr_2)_2$, $Hf(NEt_2)_4$, $Hf(NMe_2)_4$, $Hf(NMeEt)_4$, $La(NMe_2)_3$, $La(NEt_2)_3$, , $La(NMeEt)_3$, $Al(NMe_2)_3$, $Al(NEt_2)_3$, $Y(NMe_2)_3$, $Y(NEt_2)_3$, $Y(NMeEt)_3$, $Ti(NMe_2)_4$, $Ti(NEt_2)_4$, $Ti(NMeEt)_4$, $Ta(NMe_2)_5$, $Ta(NEt_2)_5$.

38.   The CVD precursor composition according to claim 31, wherein the metalloamide source reagent compound is selected from the group consisting of $Zr(NMe_2)_4$, $Zr(NEt_2)_4$, $Zr(NMeEt)_4$, $Hf(NEt_2)_4$, $Hf(NMe_2)_4$ and $Hf(NMeEt)_4$.
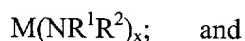
39.   A CVD precursor composition for forming a thin film dielectric on a substrate, such precursor composition including a vapor source reagent mixture including a metalloamide source reagent compound selected from the group consisting of:
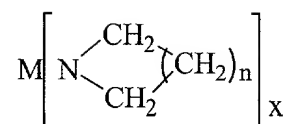
$$M(NR^1R^2)_x; \quad \text{and}$$

$$M\left[N \underset{CH_2}{\overset{CH_2}{\diagdown}} (CH_2)_n \right]_x$$

wherein M is selected from the group consisting of: Zr, Hf, Y, La, Lanthanide series elements, Ta, Ti, Al; N is nitrogen; each of R^1 and R^2 is same or different and is independently selected from the group consisting of H, aryl, perfluoroaryl, C_1-C_8 alkyl, C_1-C_8 perfluoroalkyl, alkylsilyl; and x is the oxidation state on metal M; and n is from 1-6.

40.   The CVD precursor according to claim 39, wherein the CVD precursor composition further comprises a vapor source reagent compound selected from the group consisting of: silane, trimethylsilane, tetraethylorthosilicate.
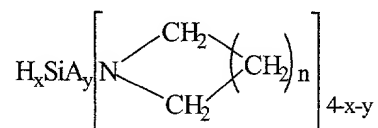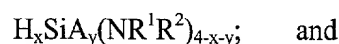
41.   A CVD precursor composition for forming a thin film dielectric on a substrate, such precursor composition including a vapor source reagent mixture including a metalloamide source reagent compound selected from the group consisting of:
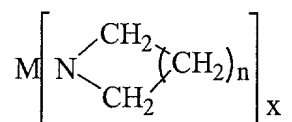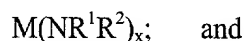
$$M(NR^1R^2)_x; \quad \text{and}$$

$$M\left[N\begin{array}{c} CH_2 \\ \diagdown \\ CH_2 \end{array}(CH_2)_n \right]_x$$

wherein M is selected from the group consisting of: Zr, Hf, Y, La, Lanthanide series elements, Ta, Ti, Al; N is nitrogen; each of R^1 and R^2 is same or different and is independently selected from the group consisting of H, aryl, perfluoroaryl, C_1-C_8 alkyl, C_1-C_8 perfluoroalkyl, alkylsilyl; and x is the oxidation state on metal M; and n is from 1-6; and

an aminosilane source reagent compound selected from the group consisting of:

$$H_xSiA_y(NR^1R^2)_{4-x-y}; \quad \text{and}$$

$$H_xSiA_y\left[N\begin{array}{c} CH_2 \\ \diagdown \\ CH_2 \end{array}(CH_2)_n \right]_{4-x-y}$$

wherein H is hydrogen; x is from 0 to 3; Si is silicon; A is a halogen; Y is from 0 to 3; N is nitrogen; each of R^1 and R^2 is same or different and is independently selected from the group consisting of H, aryl, perfluoroaryl, C_1-C_8 alkyl, and C_1-C_8 perfluoroalkyl; and n is from 1-6; x is from 0 to 3; Si is silicon; A is a halogen; Y is from 0 to 3; N is nitrogen; n is from 1-6.

42.   A CVD multi-component, single source reagent composition useful for forming a silicate thin film dielectric on a substrate, the source reagent composition comprising at least one metalloamide vapor source reagent compound selected from the group consisting of:

$$M(NR^1R^2)_x; \quad \text{and}$$

$$M\left[N\begin{array}{c} CH_2 \\ \diagdown \\ CH_2 \end{array}(CH_2)_n \right]_x$$

wherein M is selected from the group consisting of: Zr, Hf, Y, La, Lanthanide series elements, Ta, Ti, Al; N is nitrogen; each of R^1 and R^2 is same or different and is independently selected from the group consisting of H, aryl, perfluoroaryl, C_1-C_8 alkyl, C_1-C_8 perfluoroalkyl, alkylsilyl; and x is the oxidation state on metal M; and n is from 1-6; and

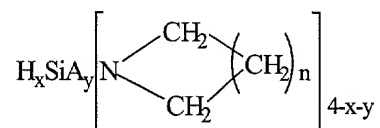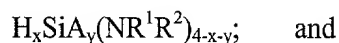an aminosilane source reagent compound selected from the group consisting of:

$$H_xSiA_y(NR^1R^2)_{4-x-y};\quad\text{and}$$

$$H_xSiA_y\left[N\underset{CH_2}{\overset{CH_2}{\diagdown}}(CH_2)_n\right]_{4-x-y}$$

wherein H is hydrogen; x is from 0 to 3; Si is silicon; A is a halogen; Y is from 0 to 3; N is nitrogen; each of R^1 and R^2 is same or different and is independently selected from the group consisting of H, aryl, perfluoroaryl, C_1-C_8 alkyl, and C_1-C_8 perfluoroalkyl; and n is from 1-6; and

a solvent medium in which the metalloamide compound and the aminosilane compound are soluble or suspendable.

43.　　A CVD method of forming a dielectric thin film on a substrate, comprising the steps of:

vaporizing a source reagent composition comprising at least one metalloamide precursor to form a source reagent precursor vapor;

transporting the source reagent precursor vapor into a chemical vapor deposition zone, optionally using a carrier gas;

contacting the source reagent precursor vapor with a substrate in said chemical vapor deposition zone at elevated temperature to deposit a dielectric thin film on the substrate.

44.　　The method according to claim 43 wherein the metalloamide precursor is selected from the group consisting of::
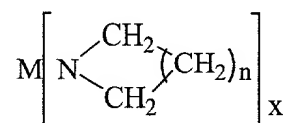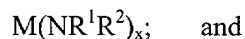
$$M(NR^1R^2)_x;\quad\text{and}$$

$$M\left[N\underset{CH_2}{\overset{CH_2}{\diagdown}}(CH_2)_n\right]_x$$

wherein M is selected from the group consisting of: Zr, Hf, Y, La, Lanthanide series elements, Ta, Ti, Al; N is nitrogen; each of R^1 and R^2 is same or different and is independently selected from the group consisting of H, aryl, perfluoroaryl, C_1-C_8 alkyl, C_1-C_8 perfluoroalkyl, alkylsilyl; and x is the oxidation state on metal M; and n is from 1-6.

45.   The CVD method according to claim 43, wherein the source reagent composition is vaporized in a liquid delivery apparatus.

46.   The CVD method according to claim 43, wherein the source reagent vapor is transported into the chemical vapor deposition chamber in a pulsed deposition mode.

47.   The CVD method according to claim 43, wherein the dielectric thin film is deposited in the absence of an oxidizer.

48.   The CVD method according to claim 43, wherein the source reagent vapor further comprises a co-reactive gas.

49.   The CVD method according to claim 48, wherein the co-reactive gas is selected from the group consisting of ozone, water vapor and reactive alcohols.

50.   The CVD method according to claim 43, wherein the metalloamide source reagent compound is selected from the group consisting of: $Zr(NMe_2)_4$, $Zr(NEt_2)_4$, $Zr(NMeEt)_4$, $Hf(NMe_2)_4$, $Hf(NEt_2)_4$.and $Hf(NMeEt)_4$

51.   The CVD method according to claim 42, wherein the metalloamide source reagent compound is $Hf(NMe_2)_4$.

52.   The CVD method according to claim 50, wherein the metalloamide source reagent compound is dissolved or suspended in octane.

53.   The CVD method according to claim 43, wherein the metalloamide source reagent compound is solubilized or suspended in a solvent.

54.   The CVD method according to claim 53, wherein the solvent is octane.

55.   The CVD method according to claim 43, wherein the metalloamide source reagent compound is Zr(NMe$_2$)$_4$.

56.   The CVD method according to claim 55, wherein the metalloamide precursor further comprises La(NMe$_2$)$_3$.

57.   The CVD method according to claim 43, wherein the metalloamide source reagent compound is, Y(NMe$_2$)$_3$.

58.   The CVD method according to claim 43, wherein the metalloamide source reagent compound comprises Hf(N(CH$_3$)$_2$)$_4$ and La(N(CH$_3$)$_2$)$_3$.

59.   The CVD method according to claim 43, further comprising an aminosilane precursor.

60.   The CVD method according to claim 57, wherein the metalloamide source reagent compound is Hf(NMe$_2$)$_4$ and the aminosilane source reagent compound is Si(NMe$_2$)$_3$Cl.

61.   The CVD method according to claim 43, wherein the carrier gas is selected from the group consisting of : He, Ar, H$_2$, N$_2$ and O$_2$.

62.   The CVD method according to claim 43, further comprising an oxidizing gas selected from the group consisting of: O$_2$, N$_2$O, NO and O$_3$.

63.   The CVD method according to claim 62, wherein the oxidizing gas is N$_2$O.

64.   The CVD method according to claim 43, further comprising an oxidizing gas, wherein the oxidizing gas is N$_2$O.

65.   The CVD method according to claim 43, wherein the metalloamide source reagent compound is vaporized at temperature in the range of from about 100°C to about 300°C.

66.   The CVD method according to claim 43, wherein the chemical vapor deposition zone is at a temperature in the range of from about 350°C to about 750°C.